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Nuclear Earth Penetrator Weapons

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Summary

The Administration's Nuclear Posture Review considered nuclear earth penetrator weapons (EPWs), which would burrow tens of feet into the ground before detonating to improve their ability to destroy buried facilities. The FY2003 Department of Energy (DOE) budget request included \$15 million to begin a study on a Robust Nuclear Earth Penetrator (RNEP). The request led to congressional and public debate because EPWs involve such policy issues as circumstances under which the United States would use nuclear weapons, military value of EPWs, and nonproliferation. This report provides background, pros, and cons. It will be updated as needed.

Background

Technical aspects. Deeply buried structures can be built to withstand an attack using conventional munitions. They may protect strategic military facilities, such as for sheltering leaders, producing biological agents, and storing nuclear weapons. Reports claim Iraq and North Korea have buried facilities for such purposes and Iran is building one.¹ The Defense Intelligence Agency estimates that over 1,400 known or suspected strategic underground facilities exist worldwide.² Some may be vulnerable only to EPWs.

Special operations forces or precision-guided conventional bombs might *defeat* deeply buried structures by attacking power supplies, ventilation systems, and exits. The only way to *destroy* them – the focus of this report – is with a strong shock wave that

¹ Glenn Kessler, "Nuclear Sites in Iran Worry U.S. Officials," *Washington Post*, December 14, 2002: 18, 21; David Fulghum, "Iraq's Hidden Weapons 'Are Likely Underground,'" *Aviation Week & Space Technology*, December 16, 2002: 44; and Joby Warrick, "Iran, N. Korea Nuclear Plans Pose New Risks," *Washington Post*, December 24, 2002: 1, 11.

² "Nuclear Posture Review [Excerpts]," p. 46 of Nuclear Posture Review (NPR); available at [<http://www.globalsecurity.org/wmd/library/policy/dod/npr.htm>]. Secretary of Defense Donald Rumsfeld confirmed that the NPR was leaked. When asked about the leak at a press conference, he said, "I am disturbed by the leak because I think it's enormously unprofessional." U.S. Department of Defense. News Transcript: "DoD News Briefing – Secretary Rumsfeld and Gen. Pace," March 15, 2002. [http://www.defenselink.mil/news/Mar2002/t03152002_t0315sd.html].

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travels through the ground. Stephen Younger, then Associate Laboratory Director for Nuclear Weapons, Los Alamos National Laboratory, wrote, “Some very hard targets require high yield to destroy them. No application of conventional explosives or even lower-yield nuclear explosives will destroy such targets, which might include hardened structures buried beneath hundreds of feet of earth or rock.” Indeed, “Superhard targets, such as those found under certain Russian mountains, may not be able to be defeated reliably by even high-yield nuclear weapons.”³

A nuclear weapon detonated on the earth’s surface transfers much of its energy into the atmosphere; one detonated underground transfers much more of its energy into the ground as shock waves. For example, a 1,000-kiloton (1-megaton) weapon surface burst has about the same effect on buried targets as a 63-, 33-, or 25-kiloton weapon detonated at a depth of 1, 5, and 10 meters, respectively.⁴ The lower yield of an EPW greatly reduces airblast, radioactive fallout, and other effects on the earth’s surface. To withstand the immense force of striking and penetrating the earth before detonating, an EPW needs a strong case and may require internal strengthening.⁵ The current EPW, the B61-11, was made by modifying an existing bomb in ways that did not require nuclear testing, but has limitations: The Nuclear Posture Review, which the Administration prepared in response to a congressional mandate and briefed to Congress in January 2002, stated, according to leaked excerpts, that the B61-11 “has a very limited ground penetration capability” and “cannot survive penetration into many types of terrain in which hardened underground facilities are located.”⁶ The Administration requested \$15 million for FY2003 to study an improved penetrator, the Robust Nuclear Earth Penetrator, or RNEP.

Two technical points are worth noting. First, RNEP is not a low-yield weapon. John Gordon, then Director of the National Nuclear Security Administration, testified that the emphasis is on “a more standard yield system called an enhanced penetrator ... There’s no design work going on low-yield nuclear weapons.”⁷ While an EPW can destroy a buried target with less yield than a surface-burst weapon, increasing the yield increases the radius of damage. R&D that could lead to the production of most new types of nuclear weapons with yields under 5 kilotons is barred by law (see below), but it does not appear that the RNEP research being contemplated would violate that “mini-nuke” provision. Second, although EPWs would reduce fallout, they would not eliminate it. A nuclear weapon of a given explosive yield creates more fallout if detonated at shallow

³ Stephen Younger, “Nuclear Weapons in the Twenty-First Century,” Los Alamos National Laboratory, LAUR-00-2850, June 27, 2000, p. 10.

⁴ Memorandum, “Comparison of Surface and Sub-Surface Nuclear Bursts,” from Steven Hatch, Sandia National Laboratories, to Jonathan Medalia, October 30, 2000.

⁵ The B61-11 modification, turning a nuclear bomb into an EPW, needed both. According to a Los Alamos publication, “The essence of the modification is a field changeout of the weapon’s case to provide an earth-penetration capability.” “B61-11 Update,” *Weapons Insider*, August 1996: 2. Further, “modifications to the warhead’s electrical system and physics package were minimal,” “B61-11 NESE Completed,” *Weapons Insider*, June/July/August 1998: 5.

⁶ “Nuclear Posture Review [Excerpts],” p. 47 of Nuclear Posture Review.

⁷ U.S. Congress. Senate. Committee on Armed Services. Hearing: Nuclear Posture Review. February 14, 2002, n.p. Transcript prepared by eMediaMillWorks, Inc.

depth than on the surface. EPWs would reduce fallout by sharply reducing the yield required to destroy a buried target.

Congressional and executive branch actions. EPWs have been an issue for years. In late 1991, the Air Force reportedly asked Los Alamos National Laboratory to study a very low yield nuclear warhead that could destroy underground bunkers.⁸ One report stated that “[p]enetrating Saddam’s hardened bunkers proved to be one of the most daunting tasks that faced the Air Force.”⁹ On the other hand, there were efforts in Congress to rein in nuclear testing and weapons development that could lead to it. FY1993 legislation mandated a U.S. nuclear test moratorium until July 1993 and efforts toward a Comprehensive Test Ban Treaty (CTBT) by September 1996.¹⁰ The Nuclear Nonproliferation Treaty (NPT) review and extension conference, which would decide whether to extend the treaty indefinitely, was set for April 1995. When the FY1994 DOE budget request sought continued support for studies on a precision low-yield warhead,¹¹ some in Congress wanted to bar very low yield nuclear weapons on grounds they could blur the distinction between conventional and nuclear conflict, undermine U.S. efforts to discourage other nations from developing nuclear weapons, and weaken prospects for NPT extension and the CTBT. Accordingly, the FY1994 National Defense Authorization Act, P.L. 103-160, section 3136, prohibited, with certain exceptions, R&D that “could lead to the production by the United States of a [new] low-yield nuclear weapon ...” It defined low yield as under five kilotons, about one-third the yield of the Hiroshima bomb.

The Department of Defense (DOD) needed DOE’s aid in studying EPWs, but in 1999 DOE’s General Counsel raised concerns about “any action that could result in producing a weapon with a yield of less than 5 kilotons” given the FY1994 provision.¹² In response to that interpretation, conferees for the FY2001 National Defense Authorization Act, P.L. 106-398, included report language for section 1044 requiring the Secretary of Defense, in conjunction with the Secretary of Energy, to report on the defeat of hardened and deeply buried targets. The resulting report reviewed the threat posed by these targets, requirements for defeating them, programs responsive to these requirements, and efforts to meet future threats.¹³

⁸ “Lab Proposes Smaller Nuclear Weapons,” Associated Press (newswire), October 8, 1992.

⁹ Tony Capaccio, “Mini-Nukes Weighed for Third World Contingencies,” *Defense Week*, September 8, 1992: 12.

¹⁰ The requirement for a moratorium and for a plan for CTBT negotiations were contained in sec. 507 of P.L. 102-377, Energy and Water Development Appropriations Act, FY1993.

¹¹ U.S. Department of Energy. Office of Chief Financial Officer. *FY1994 Congressional Budget Request, Volume 1: Atomic Energy Defense Activities*. DOE/CR-0012, April 1993, p. 46.

¹² Memorandum from Mary Anne Sullivan, General Counsel, to Thomas F. Gioconda, Brigadier General, USAF, Principal Deputy Assistant Secretary for Military Applications, Office of Defense Programs, “Statutory Prohibition on Research and Development of Low-Yield Nuclear Weapons,” March 19, 1999. See also Walter Pincus, “Senate Bill Requires Study of New Nuclear Weapon,” *Washington Post*, June 12, 2000: 2.

¹³ U.S. Secretary of Defense in Conjunction with the Secretary of Energy. *Report to Congress on the Defeat of Hard and Deeply Buried Targets*. Submitted in response to Section 1044 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, P.L. 106-398. 24 p.

For FY2003, the Administration requested \$15 million to begin a study on the RNEP. The House Armed Services Committee (H.R. 4546, H.Rept. 107-436) supported the request, and called for a National Academy of Sciences report on the effects on surrounding civilian populations of a nuclear earth penetrator and various other weapons (sec. 1018). Representative Markey introduced an amendment, which was defeated, 172-243, to bar funds for development, testing, or engineering of a nuclear EPW and to bar FY2003 funds for a feasibility study for a nuclear EPW.¹⁴ In the Senate, the Armed Services Committee (S. 2514, S.Rept. 107-151) recommended eliminating funds for the RNEP and requiring the Secretaries of Defense and Energy to report on the RNEP, including military requirements, employment policy, targets, and ability of conventional weapons to “address” types of targets that the RNEP would hold at risk (sec. 3132). The conference bill (H.R. 4546/P.L. 107-314) provided for the National Academy of Sciences report (sec. 1033), and barred obligation of FY2003 funds for the RNEP until 30 days after the report called for by the Senate Armed Services Committee report had been submitted to the Armed Services Committees (sec. 3146).

Key Issues

Should the U.S. contemplate using nuclear weapons against rogue states and terrorists? EPW supporters hold that high-value buried facilities in rogue states pose an unacceptable danger to the United States. In their view, conventional weapons cannot destroy such targets, higher-yield nuclear weapons would create unacceptable amounts of fallout and might be ineffective, and lower-yield nuclear weapons would create less fallout but would be ineffective. John Bolton, Undersecretary of State for Arms Control and International Security, said, “I think the nuclear arsenal is central to our ongoing security needs. ... where deterrence failed ... we would certainly want an arsenal that was capable of being used and being used with effectiveness.”¹⁵ In 2002, the Administration sharpened its position on nuclear weapon use. In February, the State Department repeated negative security assurances (NSAs), pledges by the United States in 1978 and 1995 not to use nuclear weapons against nonnuclear weapon states party to the Nuclear Nonproliferation Treaty (NPT) in most instances. The Department qualified the pledge by not ruling out any type of military response to the use of weapons of mass destruction (WMD) against this nation or its allies.¹⁶ In September, a Presidential document stated, “To forestall or prevent ... [attacks with WMD] by our adversaries, the United States will, if necessary, act preemptively.”¹⁷ And in December, a White House document stated, “The United States will continue to make clear that it reserves the right

¹⁴ For amendment text, debate, and vote, see *Congressional Record*, May 9, 2002: H2339-H2342.

¹⁵ “Expounding Bush’s Approach to U.S. Nuclear Security: An Interview with John R. Bolton,” *Arms Control Today*, March 2002: 6.

¹⁶ Philipp Bleck, “Bush Administration Reaffirms Negative Security Assurances,” *Arms Control Today*, March 2002: 23. For a discussion of security assurances, see U.S. Library of Congress. Congressional Research Service. *Nuclear Weapons Proliferation: The Role of Security Assurances in Nonproliferation Policy*. CRS Report 95-984 F, September 15, 1995, 42 p. By Amy Woolf and Ross Kaplan.

¹⁷ U.S. President. *The National Security Strategy of the United States of America*. September 2002, p. 15.

to respond with overwhelming force – including through resort to all of our options – to the use of WMD against the United States, our forces abroad, and friends and allies.”¹⁸

Critics hold that nuclear weapons should be used only as a last resort, e.g., in response to a nuclear attack on the United States. They argue that a high threshold for nuclear use serves U.S. interests, given the overwhelming U.S. advantage in conventional forces. They fear that EPWs would make nuclear use more likely by making it seem more acceptable. Any use of nuclear weapons, the argument continues, would end a critical norm of international behavior that has held since 1945 and would inflame world opinion against the United States, undermining nonproliferation and counterterrorism efforts. It would put potential adversaries into a use-or-lose posture with their WMD if a U.S. attack appeared likely. Thus the huge strategic risks of nuclear use far outweigh, in this view, any military gains from using EPWs against buried facilities.

Would EPWs have military utility against rogue states and terrorists?

EPW supporters contend that while conventional forces can accomplish many military missions regarding WMD, some require nuclear weapons. Adversaries learned from the Persian Gulf War and elsewhere that U.S. conventional forces can readily destroy unprotected assets. In response, they have buried key facilities. The U.S. needs EPWs to respond to their moves. Representative Hunter said:

We want to send a message to anybody who would strike America ... that we will hunt them down and find them and, if necessary, dig them out ... One way you ensure that there are no safe havens is to be able to go deep. Unless we do a lot more research and development and we find some quantum breakthrough in conventional systems, to go deep is going to require a nuclear capability.¹⁹

Critics reply that EPWs have no military utility. At the macro level, Halperin holds that nuclear weapons do not have utility and that “there are no nuclear missions.”²⁰ Regarding the specifics of EPW use, Gottemoeller argues that a nuclear environment would impede military operations and logistics, especially reconnaissance to check buried facilities following attack to make sure they were destroyed.²¹ Furthermore, only a fraction of buried facilities in adversary nations could be defeated *only* by RNEP. Some are vulnerable to nonnuclear weapons, some may be vulnerable to the B61-11, others may be invulnerable to RNEP, some may not be detected, intelligence on others may be insufficient to permit targeting, and some may be vulnerable to defeat by ground forces. Nonnuclear earth penetrators could also be improved.²²

¹⁸ U.S. White House. *National Strategy to Combat Weapons of Mass Destruction*. December 2002, p. 3.

¹⁹ Representative Duncan Hunter, colloquy on H.R. 4546, Bob Stump National Defense Authorization Act, Part A Amendment no. 3, *Congressional Record*, May 9, 2002: H2340.

²⁰ “Parsing the Nuclear Posture Review: An ACA [Arms Control Association] Panel,” *Arms Control Today*, March 2002: 19.

²¹ Rose Gottemoeller, “On Nukes, We Need to Talk,” *Washington Post*, April 2, 2002: 15.

²² Michael Levi, *Fire in the Hole: Nuclear and Non-Nuclear Options for Counterproliferation*. Carnegie Endowment for International Peace, Working Paper 31, November 2002, p. 17-20.

How might EPWs affect WMD proliferation? Supporters assert EPWs would help deter the acquisition and use of WMD because the use of EPWs can more credibly be threatened. They oppose NSAs because they shield those nations that pose the greatest danger to us. Iraq, Iran, and Libya are all members of the NPT; North Korea announced plans to withdraw in January 2003. While critics fear that new nuclear weapons could lead to testing, supporters see the argument as unwarranted for RNEP because the plan is to modify an existing warhead. According to Undersecretary of Defense Douglas Feith, the RNEP “is a consideration of a modification of an existing system.”²³ The B61-11 was modified for an EPW role without nuclear testing, and the same should be true for RNEP, supporters contend. In a broader context, some EPW supporters would favor nuclear testing to maintain current weapons and add new ones, and believe that demonstrating that U.S. nuclear weapons work would help dissuade friends and foes from going nuclear.

Critics of EPWs argue that these weapons would make proliferation more likely: Given that the most likely targets of these weapons are NPT members, even studying RNEP would undercut NSAs. Yet NSAs were crucial for obtaining the indefinite extension of the NPT in 1995. The United States loses credibility on nonproliferation if it shows the importance of nuclear weapons – “the town drunk is a poor advocate for temperance,” said Representative Frank.²⁴ Study of RNEP could lead to development and nuclear testing, yet commitment to negotiate a CTBT was crucial for obtaining the indefinite extension of the NPT. Further, U.S. testing could lead to testing by other nations. In this view, nonproliferation requires multilateral cooperation; the United States is in a weak position on this issue if it demands cooperation from others yet is unwilling to cooperate on policies others see as important to nonproliferation. U.S. pursuit of new nuclear weapons tailored to attack sites in rogue states would make potential adversaries believe they need nuclear weapons to deter U.S. attacks. This could lead more nations to go nuclear; North Korean nuclear weapons, for example, might lead South Korea and Japan to acquire such weapons. Alternatively, U.S. emphasis on nuclear weapons might, critics argue, lead other nations to develop biological weapons.²⁵

²³ U.S. Congress. Senate. Committee on Armed Services. Hearing: Nuclear Posture Review. February 14, 2002, n.p. Transcript prepared by eMediaMillWorks, Inc. See also Andrew Koch, “USA Examines Options for ‘Nuclear Package,’” *Jane’s Defence Weekly*, March 27, 2002: 3.

²⁴ Representative Barney Frank, colloquy on H.R. 4546, Bob Stump National Defense Authorization Act, Part A Amendment no. 3, *Congressional Record*, May 9, 2002: H2340.

²⁵ Letter from Representative Markey and others to Representatives Stump and Skelton on eliminating RNEP funding and on nuclear test readiness, May 1, 2002.